

Memorandum

To	Rob Law, dmi	Page	1
CC	Bill Potter, dmi Laura Kelmar, AECOM		
Subject	Updated Exposure Assumption Tables Deliverable to USEPA Region 2		
From	Betsy Ruffle and Kelly Vosnakis		
Date	August 20, 2015		

In response to USEPA Region 2's June 5, 2015 comments on the draft Baseline Human Health Risk Assessment (BHHRA) for the Lower Passaic River Study Area (LPRSA), AECOM has revised the exposure assumption tables of the draft BHHRA (Tables 4-1 to 4-7) to reflect updated guidance. As discussed with USEPA Region 2 on the June 15, 2015 technical call, the updated tables are being submitted to Region 2 with the Cooperating Parties Group's (CPG) responses to Region's 2 comments on the draft BHHRA. A summary of the updates is presented below with reference to the relevant comments. The updates to the tables are shown in yellow highlighting to aid in the review process (provided in the attachment to this memorandum).

Updates Based on 2014 Standard Default Exposure Factors Guidance (Comments 14, 68, 99, and 123)

Tables 4-2 to 4-5 have been updated to use the updated Standard Default Exposure Factors that was published in February 2014 (with minor corrections in April 2015) (USEPA 2014). Based on the 2014 guidance, several default parameters for adults were updated, including body weight, worker body surface area, and exposure duration. In cases where the default values listed in USEPA 2014 are not based on the same age groups or exposed body parts as were assumed in the RARC, updated values were calculated using the latest Exposure Factors Handbook (EFH) (USEPA 2011)¹. Tables documenting the calculations are presented in Attachment Tables 1 to 3. The calculations followed the same methodology and data used by USEPA in deriving the values for the 2014 Standard Default Exposure Factors.

Values that were updated to the defaults presented in USEPA 2014 are listed below:

- Adult body weight was updated from 70 kilograms (kg) (USEPA 1991) to 80 kg (USEPA 2014);
- Adult exposure duration was updated from 24 years (USEPA 1991) to 20 years (USEPA 2014);
- Adult (worker) body surface area for contact with sediment (hands, forearms and head) was updated from 3,300 cm² (USEPA 2002) to 3,527 cm² (USEPA 2014);

¹ The ages of each receptor was clarified on the tables, for example, the young child, which previously said 1-6 yr, was updated to state 1<7 year.

- Adult (swimmer) total body surface area for contact with surface water was updated from 18,000 cm² (USEPA 1997, 2004) to 20,900 cm² (USEPA 2014).

References for other parameters that did not change were updated to reflect the 2014 document (i.e., child exposure duration, soil ingestion rates).

Per comment 99 and USEPA (2014), the default lifetime of 70 years has been maintained.

Note that the 2014 guidance does not provide exposure factors for older children, teens, or adolescents, or for recreational scenarios.

Updates Based on 2011 Exposure Factors Handbook (Comments 29 (2nd bullet), 64 (1st paragraph), and 69a)

Specific parameters in Tables 4-2 to 4-5 have been updated from the 2008 Child EFH (USEPA 2008) to the 2011 EFH (USEPA 2011), which replaced the 2008 document. While not specifically requested in the comments, references to the 1997 version of the EFH (USEPA 1997) have also been updated to the 2011 EFH (USEPA 2011) in order to ensure the most up-to-date values are used. In most cases, this was simply a matter of changing USEPA 1997 or USEPA 2008 to USEPA 2011. However, there were also numerical changes based on this update, as follows:

Body Weight

- The default body weight of 15 kg for young children listed in USEPA 2014 is based on children ranging in age from birth to the day before the 6th birthday. However, the young child assumed to be potentially exposed to media in the LPRSA is assumed to range in age from the first birthday to the day before the 7th birthday. Therefore, the young child (age 1<7) body weight was updated to 19 kg, based on data from the 2011 EFH for ages 1<7. The calculations are provided in Attachment Table 1.
- The body weight for the older child (age 7<14) boater was updated to 43 kg (USEPA 2011) from 41 kg (USEPA 2008), as documented in Attachment Table 1.

Body Surface Area

- Updates to body surface areas for the young child, adolescent, older child, and teen, as documented in Attachment Table 2 and presented below:
 - Child (age 1<7) surface area for contact with sediment while swimming or wading (hands, lower legs, forearms, feet, and face) was updated to 2,272 cm² (USEPA 2011) from 2,500 cm² (USEPA 2008).
 - Child (age 1<7) whole body surface area for contact with surface water while swimming was updated to 7,517 cm² (USEPA 2011) from 6,600 cm² (USEPA 2008). As with body weights, the default whole body surface area presented in USEPA 2014 represents children aged 0<6, while the young child receptor for the LPRSA is aged 1<7.
 - Adolescent (age 7<19) surface area for contact with sediment while swimming or wading and for contact with surface water while wading (hands, lower legs, forearms, feet, and face) was updated to 4,436 cm² (USEPA 2011) from 5,100 cm² (USEPA 2008).
 - Adolescent (age 7<19) whole body surface area for contact with surface water while swimming was updated to 15,192 cm² (USEPA 2011) from 14,800 cm² (USEPA 2008).

- Older child (age 7<14) surface area for contact with sediment and surface water while boating (hands, lower legs, forearms, feet, and face) was updated to 3,942 (cm²) (USEPA 2011) from 4,400 cm² (USEPA 2008).
- Teen (age 14<19) surface area for contact with sediment and surface water while boating (hands, forearms, and face) was updated to 1,992 cm² (USEPA 2011) from 2,500 cm² (USEPA 2008).
- Updates to body surface areas for the adult, as documented in Attachment Table 3 and presented below:
 - Adult body surface area for contact with sediment (angler, swimmer, wader) and surface water (angler, wader) (face, hands, forearms, lower legs, and feet) was updated to 6,492 cm² (USEPA 2011) from 6,100 cm² (USEPA 1997). Note that the adult surface area presented in USEPA 2014 does not include the surface area of the feet.
 - Adult boater surface area for contact with sediment and surface water (hands, forearms, and face) was updated to 2,670 cm² (USEPA 2011) from 2,500 cm² (USEPA 1997).

Surface Water Ingestion Rate

Based on USEPA 2008, USEPA Region 2 selected surface water ingestion rates of 0.05 liters per hour (L/hr) for swimmer receptors, and one-half of the swimming rate (0.025 L/hr) for all other receptors. The same ingestion rates were applied across all age groups. The 2011 EFH provides swimming ingestion rates for both children and adults (0.049 L/hr for children aged 6-15 and 0.021 L/hr for adults). Based on USEPA (2011), the surface water ingestion rate for the adult receptors has been updated as follows:

- Adult swimmer = 0.021 L/hr
- Adult wader, boater, angler = 0.011 L/hr

Editorial Updates (Comments 176 to 181)

- Table 4-1 was updated to include language regarding inhalation of vapors (comment 176).
- CF2 was removed from Table 4-3 (comment 177).
- The intake equation which was included in the RARC was updated to reflect the dermally absorbed dose equation that was used in the BHHRA (comment 178).
- The row height for exposure frequency on Table 4-4 was increased (comment 179).
- Table 4-6 was updated to correct the footnotes for antimony and aluminum to (c), and a new footnote (d) was added to reflect that the dermal absorption factors for DDD, DDE, aldrin, dieldrin, and heptachlor epoxide are the default values for semivolatile organic compounds from RAGS Part E Exhibit 3-4 (USEPA 2004). As USEPA (2004) is the original source of the value, we believe it is the appropriate reference, rather than the suggested reference to the USEPA regional screening level table (comment 180).
- The footnote row height in Table 4-7 was increased and the definitions of (b) and (c) were added to equations A-6 through A-8 (comment 181).

References:

USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors", OSWER Directive 9285.6-03. [Replaced by USEPA 2014]

USEPA 1997. Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa. [Replaced by USEPA 2011]

USEPA 2002. Supplemental Guidance Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA 2004. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. USEPA/540/R/99/005

USEPA 2008. Child Specific Exposure Factors Handbook. EPA 600/R-06/096F. [Replaced by USEPA 2011 and USEPA 2014].

USEPA 2011. Exposure Factors Handbook: 2011 Edition. USEPA/600/R-09/052F. September 2011.

USEPA 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

TABLE 4-1
SELECTION OF EXPOSURE PATHWAYS
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Biota Tissue	Fish Tissue	Fish from 17-mile stretch of Passaic River	Angler	Child (1 < 7 years old)	Ingestion	Quantitative	Site-related contaminants have been detected in fish. Studies have found that despite Fish Advisories, individuals do fish in the study area. Assumes receptor will consume fish caught from Passaic River and share it with family members.
					Adolescent (7 to <19 years old)	Ingestion	Quantitative	
					Adult (>18 years old)	Ingestion	Quantitative	
		Crab/shellfish Tissue	Crabs from 17-mile stretch of Passaic River	Angler	Child (1 < 7 years old)	Ingestion	Quantitative	Site-related contaminants have been detected in crabs/shellfish. Studies have found that despite Fish Advisories, individuals do collect crabs from the study area. Assumes receptor will consume crabs/shellfish gathered from Passaic River and share them with family members.
					Adolescent (7 to <19 years old)	Ingestion	Quantitative	
					Adult (>18 years old)	Ingestion	Quantitative	
		Turtles, ducks, etc.	Other species from 17-mile stretch of Passaic River	Angler	Child (1 < 7 years old)	Ingestion	Qualitative	Limited data; ingestion of animals other than Passaic River fish/crabs likely to be minimal.
					Adolescent (7 to <19 years old)	Ingestion	Qualitative	
					Adult (>18 years old)	Ingestion	Qualitative	
		Fish/crab/other species	Fish/crab/other species	Transient Person	Multiple ages	Ingestion	Qualitative	Evidence of homeless camps has been observed in the study area. Limited exposure pattern data would make quantification highly uncertain. Potential risks relative to other receptors are discussed in the uncertainty section.
	Sediment	River Sediment, Mudflat Sediment (1)	17-mile stretch of Passaic River (3)	Angler	Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Angler may contact sediment while fishing or crabbing from the river bank. Assumes that young children (1 to 6 years) would not typically accompany adult anglers due to safety concerns. Inhalation may occur if activities are in mudflat areas and volatiles are present; however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	

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BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (continued)	Sediment	River Sediment, Mudflat Sediment (1)	17-mile stretch of Passaic River (3)	Swimmer	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Swimming is included in the designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (i.e., RM 8 to RM 17) (FW2-NT) (2). Swimming could also occur in other portions of the river. Swimmers may contact sediment while entering and leaving the river and while swimming. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
				Wader	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Families visiting riverside parks may contact sediment along the river. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
				Boater	Older child (7 <14 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Recreational boating is included in the designated uses of the Passaic River throughout the study area (FW2-NT, SE2, SE3) (2), and could include kayaking, canoeing, rowing/sculling. Eight high school sculling teams and two boating clubs use the river for rowing. Children (ages 7 to 13 years) may also participate in recreational boating. Docks are typically used, but boaters may occasionally contact sediment when a boat flips and wading is necessary. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Teen (14 <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
				Worker	Adult (>18 years old)	Incidental Ingestion Dermal Contact	Quantitative Quantitative	Workers may be tasked with collecting shoreline trash or other work that leads to contact with sediment along the river. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible. Contact with surface water is not typically expected to occur.
						Inhalation of Vapors	Quantitative	

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BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (continued)	Sediment	River Sediment, Mudflat Sediment (1)	17-mile stretch of Passaic River (3)	Resident	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	Residential properties are located adjacent to the river, especially above RM 10. Residents may contact river sediment during activities near their homes. Potential risks are addressed qualitatively. The inhalation pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	
					Multiple ages	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	
				Transient Person	Multiple ages	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	Evidence of homeless camps has been observed in the study area. Limited exposure pattern data would make quantification highly uncertain. Potential risks relative to other receptors are discussed in the uncertainty section. The inhalation pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
				Angler	Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Anglers may contact surface water while fishing or crabbing from the river bank. Assumes that young children (1 to 6 years) would not typically accompany adult anglers due to safety concerns. Inhalation may occur if volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
	Surface Water	Surface Water	17-mile stretch of Passaic River	Swimmer	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Swimming is included in the designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (i.e., RM 8 to RM 17) (FW2-NT) (2). Swimming could also occur in other portions of the river. Swimmers may contact surface water while swimming. Inhalation may occur if volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	

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SELECTION OF EXPOSURE PATHWAYS
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (continued)	Surface Water	Surface Water	17-mile stretch of Passaic River	Wader	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Families visiting riverside parks may contact surface water along the river. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adolescent (7 to <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
				Boater	Older child (7 <14 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	Recreational boating is included in the designated uses of the Passaic River throughout the study area (FW2-NT, SE2, SE3) (2), and could include kayaking, canoeing, rowing/sculling. Eight high school sculling teams and two boating clubs use the river for rowing. Children (ages 7 to 13 years) may also participate in recreational boating. Boaters may contact surface water while boating and occasionally when entering or leaving their crafts. Inhalation may occur if activities are in mudflat areas and volatiles are present, however, this pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Teen (14 <19 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Quantitative Quantitative Quantitative	
				Resident	Child (1 < 7 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	Residential properties are located adjacent to the river, especially above RM 10. Surface water from the river is not used as a domestic water supply. Residents may contact surface water during activities near their homes. Potential risks are addressed qualitatively. The inhalation pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
					Adult (>18 years old)	Incidental Ingestion Dermal Contact Inhalation of Vapors	Qualitative Qualitative Qualitative	
				Transient Person	Multiple ages	Incidental Ingestion	Qualitative	Evidence of homeless camps has been observed in the study area. Limited exposure pattern data would make quantification highly uncertain. Potential risks relative to other receptors are discussed in the uncertainty section. The inhalation pathway is not considered further in the BHHRA because the inhalation pathway risks are negligible.
						Dermal Contact	Qualitative	
						Inhalation of Vapors	Qualitative	

This table was originally provided by USEPA on September 10, 2010; it is reproduced with minor editorial updates and clarifications, and to reflect revisions provided by USEPA on February 10, 2011 February 6, 2012, and comments provided on June 5, 2015.

RM - River Mile.

- (1) River sediment is defined as nearshore sediment under 2 feet of water or less at mean low water. Nearshore river and mudflat sediment are combined and treated as one media, referred to as accessible surface sediment, in the baseline human health risk assessment.
- (2) NJAC 7:9B Surface Water Quality Standards classification for the Passaic River:
- Mouth of river to Second River (RM 0 to RM 8) is classified as saline-estuarine 3 (SE3). Designated use for SE3 water includes secondary contact recreation: recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing.
 - Second River to Dundee Dam (RM 8 to RM 17) is classified as freshwater 2 non-trout (FW2-NT) and saline-estuarine 2 (SE2). Designated use for FW2-NT and SE2 water includes secondary contact recreation (e.g., boating and fishing). Designated use for FW2-NT water also includes primary contact recreation: recreational activities that involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing.
- (3) Accessible sediments were evaluated on both a sitewide basis and an exposure area basis, where the Study Area was divided into six three-mile segments (RM 0-3, 3-6, 6-9, 9-12, 12-15, 15-17.4).

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:		Current/Future	
Medium:		Sediment	
Exposure Medium:		Accessible Surface Sediment	

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Incidental Ingestion	Angler	Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
		Adult (>18 year)	Sediment	AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	Intake (mg/kg-day) = CS x CF1 x IR-S x EF x ED x 1/BW x 1/AT
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
				CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
	Swimmer	Child (1 <7 year)	Sediment	ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	Intake (mg/kg-day) = CS x CF1 x IR-S x EF x ED x 1/BW x 1/AT
				CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	
				IR-S	Ingestion Rate of Sediment	mg/day	100	50% of the default residential child soil IR (USEPA 2014)	50	50% of RME	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Incidental Ingestion (continued)	Swimmer	Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	Intake (mg/kg-day) =
				CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	
	Wader	Adult (≥ 18 year)	Sediment	IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	Intake (mg/kg-day) =
				CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	
				IR-S	Ingestion Rate of Sediment	mg/day	100	50% of the default residential child soil IR (USEPA 2014)	50	50% of RME	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	Arsenic intakes are also multiplied by an RBA of 0.6 (3)
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Incidental Ingestion (continued)	Wader	Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	Arsenic intakes are also multiplied
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
		Adult (≥ 18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	Arsenic intakes are also multiplied
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Boater	Older Child (7 < 14 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential child soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	Arsenic intakes are also multiplied
				ED	Exposure Duration	years	7	(1)	3	Approximately 50% of RME	by an RBA of 0.6 (3)
				BW	Body Weight	kg	43	USEPA 2011 (mean, ages 7<14)	43	USEPA 2011 (mean, ages 7<14)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,555	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Incidental Ingestion (continued)	Boater	Teen (14 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	4	1 day/month, 3.5 months	2	Approximately 50% of RME	
				ED	Exposure Duration	years	5	(1)	3	Approximately 50% of RME	Arsenic intakes are also multiplied
				BW	Body Weight	kg	66	USEPA 2011 (mean, ages 14<19)	66	USEPA 2011 (mean, ages 14<19)	by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	1,825	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adult (≥ 18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default residential adult soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	9	1 day/month, 8.5 months	4	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	Arsenic intakes are also multiplied
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Worker	Adult (≥ 18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	50	50% of the default outdoor worker soil IR (USEPA 2014)	25	50% of RME	1/BW x 1/AT
				EF	Exposure Frequency	days/year	50	1 day/week, 50 weeks/year	25	50% of RME	
				ED	Exposure Duration	years	25	USEPA 2014	7	USEPA 2011	Arsenic intakes are also multiplied
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	by an RBA of 0.6 (3)
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	9,125	ED (year) x 365 days/year	2,555	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal	Angler	Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
				CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
		Adult (> 18 year)	Sediment	EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal (continued)	Swimmer	Child (1 <7 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
		Adult (>18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal (continued)	Wader	Child (1 <7 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adolescent (7 < 19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	39	3 days/week, 3 month/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
		Adult (>18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal (continued)	Boater	Older Child (7 <14 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	3,942	Mean value for 7<14 years: face, hands, forearms, lower legs, feet (USEPA 2011)	3,942	Mean value for 7<14 years: face, hands, forearms, lower legs, feet (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	7	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	43	USEPA 2011 (mean, ages 7-14)	43	USEPA 2011 (mean, ages 7-14)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,555	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Teen (14 <19 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	1,992	Mean value for 14<19 years: face, hands, forearms (USEPA 2011)	1,992	Mean value for 14<19 years: face, hands, forearms (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	0.2	50th percentile surface area weighted soil adherence data for children playing in wet soil (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	4	1 day/month, 3.5 months	2	Approximately 50% of RME	
				ED	Exposure Duration	years	5	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	66	USEPA 2011 (mean, ages 14<19)	66	USEPA 2011 (mean, ages 14<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	1,825	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adult (>18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	—	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	2,692	Mean value for adults: face, hands, forearms (USEPA 2011)	2,692	Mean value for adults: face, hands, forearms (USEPA 2011)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	9	1 day/month, 8.5 months	4	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

TABLE 4-2
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SEDIMENT
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Accessible Surface Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal (continued)	Worker	Adult (>18 year)	Sediment	CS	Chemical Concentration in Sediment	mg/kg	chemical-specific		chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF1	Conversion Factor 1	kg/mg	1E-06	—	1E-06	--	CS x CF1 x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm ²	3,527	Mean default value for workers: head, hands, forearms (USEPA 2014)	3,527	Mean default value for workers: head, hands, forearms (USEPA 2014)	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm ²	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	0.3	50% value for adult (reed gatherer): hands, lower legs, forearms, and feet (USEPA 2004)	
				ABS	Absorption Factor	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				EF	Exposure Frequency	days/year	50	1 day/week, 50 wks/year	25	50% of RME	
				ED	Exposure Duration	years	25	USEPA 2014	7	USEPA 2011	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	9,125	ED (year) x 365 days/year	2,555	ED (year) x 365 days/year	

This table was originally provided by USEPA on September 10, 2010; it is reproduced with editorial updates and clarifications, and to reflect revisions provided by USEPA on February 10, 2011 and February 6, 2012.

In addition, the table has been revised to reflect current USEPA guidance as of June 2015, per USEPA comments dated June 5, 2015.

The references, naming conventions and units used by USEPA for each parameter have been retained; in some cases, parameter names and intake equations differ from the report text.

The inhalation of outdoor air pathway is evaluated via a screening assessment in Appendix D; based on the findings that the air pathway poses negligible risk, the exposure pathway assumptions have been removed from this table.

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

(1) Based on age group of receptor.

(2) Professional judgment.

(3) Recommendations for Default Value for Relative Bioavailability (RBA) of Arsenic in Soil. OSWER Directive 9200.1-113. USEPA, December 2012. Consistent with the approach used by the June 2015 Regional Screening Level (RSL) table (USEPA, 2015b).

Sources:

USEPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. USEPA/540/1-89/002

USEPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 935.4-24

USEPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. USEPA/540/R/99/005

USEPA 2011: Exposure Factors Handbook: 2011 Edition. USEPA/600/R-09/052F. September 2011.

USEPA 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Ingestion	Angler	Adolescent (7 < 19 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	
				ET	Exposure Time	hours/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
		Adult (≥18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.011	50% of the mean swimming rate for adults (USEPA 2011)	0.011	50% of the mean swimming rate for adults (USEPA 2011)	
				ET	Exposure Time	hours/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Swimmer	Child (1 < 7 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.05	mean swimming rate for children 6-15 yrs (USEPA 2011)	0.05	mean swimming rate for children 6-15 yrs (USEPA 2011)	
				ET	Exposure Time	hours/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adolescent (7 < 19 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.05	mean swimming rate for children 6-15 yrs (USEPA 2011)	0.05	mean swimming rate for children 6-15 yrs (USEPA 2011)	
				ET	Exposure Time	hours/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Ingestion (continued)	Swimmer	Adult (≥18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.021	mean swimming rate for adults (USEPA 2011)	0.021	mean swimming rate for adults (USEPA 2011)	
				ET	Exposure Time	hours/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Wader	Child (1 < 7 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	
				ET	Exposure Time	hours/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adolescent (7 < 19 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	
				ET	Exposure Time	hours/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	
		Adult (≥18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.011	50% of the mean swimming rate for adults (USEPA 2011)	0.011	50% of the mean swimming rate for adults (USEPA 2011)	
				ET	Exposure Time	hours/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Ingestion (continued)	Boater	Older Child (7 <14 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	
				ET	Exposure Time	hours/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	7	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	43	USEPA 2011 (mean, ages 7<14)	43	USEPA 2011 (mean, ages 7<14)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,555	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
				CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
		Teen (14 < 19 year)	Surface Water	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				IR-W	Ingestion Rate of Water	L/hour	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	0.025	50% of the mean swimming rate for children age 6-15 (USEPA 2011)	
				ET	Exposure Time	hours/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	98	7 days/wk for 14 weeks (3)	70	5 days/wk for 14 weeks (3)	
				ED	Exposure Duration	years	5	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	66	USEPA 2011 (mean, ages 14<19)	66	USEPA 2011 (mean, ages 14<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	1,825	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
				CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hour	0.011	50% of the mean swimming rate for adults (USEPA 2011)	0.011	50% of the USEPA 2011 mean for adults	Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				ET	Exposure Time	hours/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	259	7 days/wk for 37 weeks (3)	111	3 days/wk for 37 weeks (3)	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
Dermal	Angler	Adolescent (7 < 19 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermally Absorbed Dose (mg/kg-day) = DAevent x EF x EV x ED x SA x 1/BW x 1/AT Inorganics: DAevent = CW x PC x ET x CF2 Organics: If ET ≤ t*, then DAevent = 2 FA x PC x CW x CF2 x [square root (6T x ET/pie)] If ET > t*, then DAevent = FA x PC x CW x CF2 x [(ET/(1 + B)) + 2T x ((1 + 3B + 3B2)/(1 + B)2)]
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm²	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Dermal (continued)	Angler	Adult (≥18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 \text{ FA} \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $\text{FA} \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Swimmer	Child (1 <7 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 \text{ FA} \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $\text{FA} \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	7,517	Mean value for 1<7 years: whole body (USEPA 2011)	7,517	Mean value for 1<7 years: whole body (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
		Adolescent (7 <19 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 \text{ FA} \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $\text{FA} \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	15,192	Mean value for 7<18 years: whole body (USEPA 2011)	15,192	Mean value for 7<18 years: whole body (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Dermal (continued)		Adult (≥18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} = 2 FA \times PC \times CW \times CF2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} = FA \times PC \times CW \times CF2 \times [(ET/(1+B)) + 2T \times ((1+3B+3B2)/(1+B2))]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	20,900	Resident default whole body (USEPA 2014)	20,900	Resident default whole body (USEPA 2014)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2.6	National average for swimming (USEPA 1989)	2.6	National average for swimming (USEPA 1989)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Wader	Child (1 < 7 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} = 2 FA \times PC \times CW \times CF2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} = FA \times PC \times CW \times CF2 \times [(ET/(1+B)) + 2T \times ((1+3B+3B2)/(1+B2))]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	2,272	Mean value for 1<7 years: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
				CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} = 2 FA \times PC \times CW \times CF2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} = FA \times PC \times CW \times CF2 \times [(ET/(1+B)) + 2T \times ((1+3B+3B2)/(1+B2))]$
		Adolescent (7 < 19 year)	Surface Water	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	4,436	Mean value for 7<18 years: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	39	3 day/week, 3 months/year	20	Approximately 50% of RME	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Dermal (continued)		Adult (>18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 FA \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $FA \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	6,492	Mean value for adults: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1.0	(2)	0.5	(2)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	
	Boater	Older Child (7 <14 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 FA \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $FA \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	3,942	Mean value for 7<14 years: face, hands, forearms, lower legs, feet (USEPA 2011)	3,942	Mean value for 7<14 years: face, hands, forearms, lower legs, feet (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	13	1 day/week, 3 months/year	7	Approximately 50% of RME	
				ED	Exposure Duration	years	7	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	43	USEPA 2011 (mean, ages 7<14)	43	USEPA 2011 (mean, ages 7<14)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,555	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
	Teen (14 < 19 year)		Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF_2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 FA \times PC \times CW \times CF_2$ $\times [\text{square root}(6T \times ET/\text{pie})]$ If $ET > t^*$, then $DA_{event} =$ $FA \times PC \times CW \times CF_2 \times [(ET/(1+B)) + 2T$ $\times ((1+3B+3B^2)/(1+B)^2)]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	1,992	Mean value for 14<19 years: face, hands, forearms (USEPA 2011)	1,992	Mean value for 14<19 years: face, hands, forearms (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	98	7 days/wk for 14 weeks (3)	70	5 days/wk for 14 weeks (3)	
				ED	Exposure Duration	years	5	(1)	3	Approximately 50% of RME	
				BW	Body Weight	kg	66	USEPA 2011 (mean, ages 14<19)	66	USEPA 2011 (mean, ages 14<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	1,825	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	

TABLE 4-3
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - SURFACE WATER
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Reference	Value	Reference	
Dermal (continued)		Adult (>18 year)	Surface Water	CW	Chemical Concentration in Water	µg/L	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times EF \times EV \times ED \times SA$ $\times 1/BW \times 1/AT$ <u>Inorganics:</u> $DA_{event} = CW \times PC \times ET \times CF2$ <u>Organics:</u> If $ET \leq t^*$, then $DA_{event} =$ $2 FA \times PC \times CW \times CF2$ $\times [\text{square root } (6T \times ET/\pi)]$ If $ET > t^*$, then $DA_{event} =$ $FA \times PC \times CW \times CF2 \times [(ET/(1 + B)) + 2T$ $\times \{(1 + 3B + 3B2)/(1 + B)2\}]$
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm ²	2,692	Mean value for adults: face, hands, forearms (USEPA 2011)	2,692	Mean value for adults: face, hands, forearms (USEPA 2011)	
				PC	Permeability Coefficient	cm/hr	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				FA	Fraction absorbed water	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				t*	Time to reach steady state, 2.4t	hour	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				T	lag time	hour/event	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				B	Relative contribution of PC	unitless	Chemical-specific	USEPA 2004	Chemical-specific	USEPA 2004	
				CF2	Conversion Factor 2	L/cm ³	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	2	(3)	1.5	(3)	
				EF	Exposure Frequency	days/year	259	7 days/wk for 37 weeks (3)	111	3 days/wk for 37 weeks (3)	
				ED	Exposure Duration	years	20	USEPA 2014	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

This table was originally provided by USEPA on September 10, 2010; it is reproduced with editorial updates and clarifications, and to reflect revisions provided by USEPA on February 10, 2011 and February 6, 2012.

In addition, the table has been revised to reflect current USEPA guidance as of June 2015, per USEPA comments dated June 5, 2015.

The references, naming conventions and units used by USEPA for each parameter have been retained; in some cases, parameter names and intake equations differ from the report text.

The inhalation of outdoor air pathway is evaluated via a screening assessment in Appendix D; based on the findings that the air pathway poses negligible risk, the exposure pathway assumptions have been removed from this table.

RME - Reasonable Maximum Exposure.

CTE - Central Tendency Exposure.

(1) Based on age group of receptor.

(2) Professional judgement.

(3) Based on information provided by rowing clubs that use the Passaic River.

(4) The table provided by USEPA did not include exposure time for ingestion; therefore, this parameter has been included based on the dermal water exposure times, since ingestion rates are hourly.

Sources:

USEPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. USEPA/540/1-89/002

USEPA 2002: Supplemental Guidance Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

USEPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E. Supplemental Guidance for Dermal Risk Assessment. USEPA/540/R/99/005

USEPA 2011: Exposure Factors Handbook: 2011 Edition. USEPA/600/R-09/052F. September 2011.

USEPA 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

TABLE 4-4
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - FISH TISSUE
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe: Current/Future
Medium: Fish tissue
Exposure Medium: Fish tissue (filet)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/Reference	Value	Rationale/Reference	
Ingestion	Angler	Child (1 < 7 year)	Fish	C _f	Chemical Concentration in Fish	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = $C_f \times CF \times IR_f \times FI \times (1 - Loss) \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	
				IR _f	Ingestion Rate of Fish	g/day	11.5	1/3 the adult ingestion rate (USEPA 2011)	1.3	1/3 the adult ingestion rate (USEPA 2011)	
				FI	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in fish	chemical-specific	USEPA 2000	
				EF	Exposure Frequency	days/year	365	Fish ingestion rate already averaged over one year	365	Fish ingestion rate already averaged over one year	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (years) x 365 days/year	1,095	ED (years) x 365 days/year	
		Adolescent (7 < 19 year)	Fish	C _f	Chemical Concentration in Fish	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = $C_f \times CF \times IR_f \times FI \times (1 - Loss) \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	
				IR _f	Ingestion Rate of Fish	g/day	23.1	2/3 the adult ingestion rate (USEPA 2011)	2.6	2/3 the adult ingestion rate (USEPA 2011)	
				FI	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in fish	chemical-specific	USEPA 2000	
				EF	Exposure Frequency	days/year	365	Fish ingestion rate already averaged over one year	365	Fish ingestion rate already averaged over one year	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (years) x 365 days/year	2,190	ED (years) x 365 days/year	

TABLE 4-4
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - FISH TISSUE
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Fish tissue
Exposure Medium:	Fish tissue (filet)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/Reference	Value	Rationale/Reference	
Ingestion (continued)	Angler	Adult (>18 year)	Fish	C _i	Chemical Concentration in Fish	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = $C_f \times C_F \times I R_f \times F_i \times (1 - \text{Loss}) \times E F \times E D \times 1/BW \times 1/AT$
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	
				IR _f	Ingestion Rate of Fish	g/day	34.6	Average of 90th percentile estimates for consumers from USEPA Region 2 reanalysis of Burger 2002 (37.3 g/day) and Connelly et al. 1992 (32 g/day)	3.9	Average of 50th percentile for consumers from USEPA Region 2 reanalysis of Burger 2002 (3.7 g/day) and 50th percentile from Connelly et al. 1992 (4 g/day)	
				F _i	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in Fish	chemical-specific	USEPA 2000	
				EF	Exposure Frequency	days/year	365	Fish ingestion rate already averaged over one year	365	Fish ingestion rate already averaged over one year	
				ED	Exposure Duration	years	20	USEPA 2014 (2)	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (years) x 365 days/year	3,285	ED (years) x 365 days/year	

This table was originally provided by USEPA on September 10, 2010; it is reproduced with editorial updates and clarifications, and to reflect revisions provided by USEPA on February 10, 2011 and February 6, 2012.

In addition, the table has been revised to reflect current USEPA guidance as of June 2015, per USEPA comments dated June 5, 2015.

The references, naming conventions and units used by USEPA for each parameter have been retained; in some cases, parameter names and intake equations differ from the report text.

RME - Reasonable Maximum Exposure.

CTE - Central Tendency Exposure.

(1) Based on age group of receptor.

(2) Based on standard default of 26 years upper bound residential tenure at one location, minus the years spent as young child.

Sources:

Burger 2002: Consumption Patterns and Why People Fish. *Environmental Research*. Section A 90, 125-135

Connelly et al. 1992: Effects of the Health Advisory and Advisory Changes on Fishing Habits and Fish Consumption in New York Fisheries. Human Dimension Research Unit, Dept of Natural Resources, NYS College of Agriculture and Life Sciences, Cornell University, Ithaca, NY.

USEPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. USEPA/540/1-89/002

USEPA 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits - Third Edition. Appendix C. USEPA 823-B-00-008.

USEPA 2011: Exposure Factors Handbook: 2011 Edition. USEPA/600/R-09/052F. September 2011.

USEPA 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

TABLE 4-5
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - CRAB TISSUE
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe: Current/Future			
Medium: Crab tissue			
Exposure Medium: Edible crab tissue			

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Angler	Child (1 < 7 year)	Crab	C _b	Chemical Concentration in Crab	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) = Cb x CF x IR _b x FI x (1-Loss) x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	
				IR _b	Ingestion Rate of Crab	g/day	7	1/3 the adult ingestion rate (USEPA 2011)	1	1/3 the adult ingestion rate (USEPA 2011)	
				FI	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in crab	chemical-specific	chemical-specific	
				EF	Exposure Frequency	days/year	365	Crab ingestion rate already averaged over one year	365	Crab ingestion rate already averaged over one year	
				ED	Exposure Duration	years	6	USEPA 2014 (1)	3	50% of RME	
				BW	Body Weight	kg	19	USEPA 2011 (mean, ages 1<7)	19	USEPA 2011 (mean, ages 1<7)	
		Adolescent (7 < 19 year)	Crab	AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	Intake (mg/kg-day) = Cb x CF x IR _b x FI x (1-Loss) x EF x ED x 1/BW x 1/AT
				AT-N	Averaging Time (Noncancer)	days	2,190	ED (year) x 365 days/year	1,095	ED (year) x 365 days/year	
				C _b	Chemical Concentration in Crab	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	
				IR _b	Ingestion Rate of Crab	g/day	14	2/3 the adult ingestion rate (USEPA 2011)	2	2/3 the adult ingestion rate (USEPA 2011)	
				FI	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in crab	chemical-specific	chemical-specific	
				EF	Exposure Frequency	days/year	365	Crab ingestion rate already averaged over one year	365	Crab ingestion rate already averaged over one year	
				ED	Exposure Duration	years	12	(1)	6	50% of RME	
				BW	Body Weight	kg	52	USEPA 2011 (mean, ages 7<19)	52	USEPA 2011 (mean, ages 7<19)	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	4,380	ED (year) x 365 days/year	2,190	ED (year) x 365 days/year	

TABLE 4-5
VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS - CRAB TISSUE
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Scenario Timeframe:	Current/Future
Medium:	Crab tissue
Exposure Medium:	Edible crab tissue

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion (continued)	Angler	Adult (>18 year)	Crab	C _b	Chemical Concentration in Crab	mg/kg wet weight	chemical-specific	chemical-specific	chemical-specific	chemical-specific	Intake (mg/kg-day) =
				CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	Cb x CF x IR _b x FI x (1-Loss) x EF x ED x
				IR _b	Ingestion Rate of Crab	g/day	21	90th percentile estimate for consumers from Burger 2002 (3)	3	Mean for consumers from Burger 2002 (3)	1/BW x 1/AT
				FI	Fraction from source	unitless	1	Assumes 100% exposure is from Passaic River	1	Assumes 100% exposure is from Passaic River	
				Loss	Cooking Loss	g/g	0	Assumes 100% chemical remains in crab	chemical-specific	chemical-specific	
				EF	Exposure Frequency	days/year	365	Crab ingestion rate already averaged over one year	365	Crab ingestion rate already averaged over one year	
				ED	Exposure Duration	years	20	USEPA 2014 (2)	9	USEPA 1989	
				BW	Body Weight	kg	80	USEPA 2014	80	USEPA 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	70-year lifetime x 365 days/year	25,550	70-year lifetime x 365 days/year	
				AT-N	Averaging Time (Noncancer)	days	7,300	ED (year) x 365 days/year	3,285	ED (year) x 365 days/year	

This table was originally provided by USEPA on September 10, 2010; it is reproduced with editorial updates and clarifications, and to reflect revisions provided by USEPA on February 10, 2011 and February 6, 2012.

In addition, the table has been revised to reflect current USEPA guidance as of June 2015, per USEPA comments dated June 5, 2015.

The references, naming conventions and units used by USEPA for each parameter have been retained; in some cases, parameter names and intake equations differ from the report text.

RME - Reasonable Maximum Exposure.

CTE - Central Tendency Exposure.

(1) Based on age group of receptor

(2) Based on standard default of 26 years upper bound residential tenure at one location, minus the years spent as young child.

(3) USEPA Region 2 reanalysis of Burger (2002) using site-specific edible crab tissue weight of 45 g.

Sources:

Burger 2002: Consumption Patterns and Why People Fish. *Environmental Research*. Section A 90, 125-135

USEPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. USEPA/540/1-89/002

USEPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

USEPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. USEPA/540/R/99/005

USEPA 2011: Exposure Factors Handbook: 2011 Edition. USEPA/600/R-09/052F. September 2011.

USEPA 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

TABLE 4-6
DEFAULT ABSORPTION FACTORS
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Chemical of Potential Concern	CAS Number	Oral - Incidental Sediment Ingestion		Dermal - Sediment Contact	
		Default		Default	
PCDDs/PCDFs					
TCDD-TEQ	TCDD-TEQ	1	(a)	0.03	(c)
PCBs					
PCBs, total	1336-36-3	1	(a)	0.14	(c)
PCB-TEQ	PCB-TEQ	1	(a)	0.03	(c)
Inorganics					
Aluminum	7429-90-5	1	(a)	NA	(c)
Antimony	7440-36-0	1	(a)	NA	(c)
Arsenic, inorganic	7440-38-2	0.6	(b)	0.03	(c)
Cadmium, diet	7440-43-9	1	(a)	0.001	(c)
Chromium, total	7440-47-3	1	(a)	NA	(c)
Chromium, hexavalent	18540-29-9	1	(a)	NA	(c)
Cobalt	7440-48-4	1	(a)	NA	(c)
Copper	7440-50-8	1	(a)	NA	(c)
Lead	7439-92-1	1	(a)	NA	(c)
Manganese, nondiet	7439-96-5	1	(a)	NA	(c)
Mercury, inorganic	7487-94-7	1	(a)	NA	(c)
Selenium	7782-49-2	1	(a)	NA	(c)
Silver	7440-22-4	1	(a)	NA	(c)
Thallium	7440-28-0	1	(a)	NA	(c)
Vanadium	7440-62-2	1	(a)	NA	(c)
Zinc	7440-66-6	1	(a)	NA	(c)
Pesticides					
2,4-DDD	53-19-0	1	(a)	0.1	(c,d)
2,4-DDE	3424-82-6	1	(a)	0.1	(c,d)
2,4-DDT	789-02-6	1	(a)	0.03	(c)
4,4'-DDD	72-54-8	1	(a)	0.1	(c,d)
4,4'-DDE	72-55-9	1	(a)	0.1	(c,d)
4,4'-DDT	50-29-3	1	(a)	0.03	(c)
Aldrin	309-00-2	1	(a)	0.1	(c,d)
cis-Chlordane	5103-71-9	1	(a)	0.04	(c)
cis-Nonachlor	5103-73-1	1	(a)	0.04	(c)
Dieldrin	60-57-1	1	(a)	0.1	(c,d)
Gamma-Chlordane	5566-34-7	1	(a)	0.04	(c)
Heptachlor Epoxide	1024-57-3	1	(a)	0.1	(c,d)
Oxychlordane	27304-13-8	1	(a)	0.04	(c)
trans-Nonachlor	39765-80-5	1	(a)	0.04	(c)
PAHs					
Benzo(a)anthracene	56-55-3	1	(a)	0.13	(c)
Benzo(a)pyrene	50-32-8	1	(a)	0.13	(c)
Benzo(b)fluoranthene	205-99-2	1	(a)	0.13	(c)
Benzo(k)fluoranthene	207-08-9	1	(a)	0.13	(c)
C2-Benzanthracene/chrysenes	BACC2	1	(a)	0.13	(c)
C2-Naphthalene	NPHC2	1	(a)	0.13	(c)
C3-Naphthalene	NPHC3	1	(a)	0.13	(c)
C4-Naphthalene	NPHC4	1	(a)	0.13	(c)
Chrysene	218-01-9	1	(a)	0.13	(c)
Dibenz(a,h)anthracene	53-70-3	1	(a)	0.13	(c)
Indeno(1,2,3-cd)pyrene	193-39-5	1	(a)	0.13	(c)
Naphthalene	91-20-3	1	(a)	0.13	(c)
SVOCs	0				
1,1-Biphenyl	92-52-4	1	(a)	0.1	(c,d)
bis(2-Ethylhexyl) phthalate	117-81-7	1	(a)	0.1	(c,d)
Hexachlorobenzene	118-74-1	1	(a)	0.1	(c,d)
TPH					
TPH C9-C18	TPHC9-C18	1	(a)	0.1	(c,d)
TPH C19-C40	TPHC19-C40	1	(a)	0.1	(c,d)
VOCs					
Benzene	71-43-2	1	(a)	NA	(c)

TABLE 4-6
DEFAULT ABSORPTION FACTORS
LOWER PASSAIC RIVER STUDY AREA
BASELINE HUMAN HEALTH RISK ASSESSMENT

Chemical of Potential Concern	CAS Number	Oral - Incidental Sediment Ingestion	Dermal - Sediment Contact
		Default	Default
Chloroform	67-66-3	1 (a)	NA (c)
Trichloroethene	79-01-6	1 (a)	NA (c)

Notes:

CAS - Chemical Abstracts Service.

NA - Not Applicable. Chemical is not assessed via this pathway.

PAH - Polycyclic Aromatic Hydrocarbons.

PCB - Polychlorinated Biphenyls.

PCDD - Polychlorinated dibenzodioxins.

PCDF - Polychlorinated dibenzofurans.

SVOC - Semi-Volatile Organic Compounds.

TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin.

TEQ - Toxicity Equivalence.

TPH - Total Petroleum Hydrocarbons.

VOC - Volatile Organic Compounds.

(a) Absorption is assumed to be 100% (absorption factor = 1) (USEPA, 1989; 2015b).

(b) Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. OSWER Directive 9200.1-113. USEPA, December 2012.

Consistent with the approach used in the June 2015 Regional Screening Level (RSL) table (USEPA, 2015b).

(c) USEPA, 2004. Risk Assessment Guidance for Superfund. Vol. 1, Part E. July, 2004. Exhibit 3-4.

(d) Value for semivolatile organic compounds identified in Exhibit 3-4 of USEPA (2004).

TABLE 4-7
DERMAL WATER PARAMETERS
LOWER PASSAIC RIVER STUDY AREA A
BASELINE HUMAN HEALTH RISK ASSESSMENT

Chemical of Potential Concern	CAS Number	Constituent Properties		Dermal Water Parameters											Source
		MW g/mol	log Kow unitless	Kp (cm/hr)	B unitless	Lag Time □ hr/event	t* hr	FA unitless	Isc cm	log(Dsc/Isc) unitless	Dsc/Isc unitless	Dsc unitless	b unitless	c unitless	
PCDDs/PCDFs															
TCDD-TEQ	TCDD-TEQ	3.22E+02	6.80E+00	8.07E-01	5.57E+00	6.82E+00	3.01E+01	5.00E-01	1.00E-03	-4.61E+00	2.44E-05	2.44E-08	2.19E+01	5.62E+00	(a)
PCBs															
PCBs, total	1336-36-3	3.61E+02	6.72E+00	4.32E-01	3.15E+00	1.13E+01	4.79E+01	5.00E-01	1.00E-03	-4.83E+00	1.48E-05	1.48E-08	7.75E+00	3.23E+00	(a,e)
PCB-TEQ	PCB-TEQ	3.61E+02	6.72E+00	4.32E-01	3.15E+00	1.13E+01	4.79E+01	5.00E-01	1.00E-03	-4.83E+00	1.48E-05	1.48E-08	7.75E+00	3.23E+00	(a,e)
Inorganics															
Aluminum	7429-90-5	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Antimony	7440-36-0	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Arsenic, inorganic	7440-38-2	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Chromium, total	7440-47-3	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Cobalt	7440-48-4	--	--	4.00E-04	--	--	--	--	--	--	--	--	--	--	(b)
Lead	7439-92-1	--	--	1.00E-04	--	--	--	--	--	--	--	--	--	--	(b)
Manganese, nondiet	7439-96-5	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Thallium	7440-28-0	--	--	1.00E-03	--	--	--	--	--	--	--	--	--	--	(b)
Pesticides															
Dieldrin	60-57-1	3.81E+02	4.56E+00	1.22E-02	9.18E-02	1.46E+01	3.51E+01	8.00E-01	1.00E-03	-4.94E+00	1.14E-05	1.14E-08	3.62E-01	3.97E-01	(a)
PAHs															
Benzo(a)anthracene	56-55-3	2.28E+02	5.66E+00	4.74E-01	2.75E+00	2.03E+00	8.53E+00	1.00E+00	1.00E-03	-4.09E+00	8.20E-05	8.20E-08	6.12E+00	2.84E+00	(a)
Benzo(a)pyrene	50-32-8	2.50E+02	6.10E+00	7.01E-01	4.27E+00	2.69E+00	1.17E+01	1.00E+00	1.00E-03	-4.21E+00	6.19E-05	6.19E-08	1.33E+01	4.33E+00	(a)
Benzo(b)fluoranthene	205-99-2	2.52E+02	6.12E+00	7.02E-01	4.29E+00	2.77E+00	1.20E+01	1.00E+00	1.00E-03	-4.22E+00	6.01E-05	6.01E-08	1.35E+01	4.35E+00	(a)
Dibenz(a,h)anthracene	53-70-3	2.78E+02	6.84E+00	1.51E+00	9.68E+00	3.88E+00	1.76E+01	6.00E-01	1.00E-03	-4.37E+00	4.29E-05	4.29E-08	6.29E+01	9.71E+00	(a)
Indeno(1,2,3-cd)pyrene	193-39-5	2.76E+02	6.58E+00	1.04E+00	6.65E+00	3.78E+00	1.68E+01	6.00E-01	1.00E-03	-4.36E+00	4.41E-05	4.41E-08	3.06E+01	6.70E+00	(a)
Naphthalene	91-20-3	1.28E+02	3.30E+00	4.66E-02	2.03E-01	5.58E-01	1.34E+00	1.00E+00	1.00E-03	-3.52E+00	2.99E-04	2.99E-07	4.41E-01	4.80E-01	(a)
SVOCs															
1,1-Biphenyl	92-52-4	1.54E+02	3.98E+00	9.43E-02	4.50E-01	7.80E-01	1.87E+00	1.00E+00 (d)	1.00E-03	-3.67E+00	2.14E-04	2.14E-07	6.59E-01	6.80E-01	(c)
bis(2-Ethylhexyl) phthalate	117-81-7	3.91E+02	5.11E+00	2.49E-02	1.90E-01	1.66E+01	3.99E+01	8.00E-01	1.00E-03	-5.00E+00	1.00E-05	1.00E-08	4.31E-01	4.70E-01	(a)
VOCs															
Benzene	71-43-2	7.81E+01	2.13E+00	1.49E-02	5.05E-02	2.92E-01	7.00E-01	1.00E+00	1.00E-03	-3.24E+00	5.71E-04	5.71E-07	3.35E-01	3.68E-01	(a)
Chloroform	67-66-3	1.19E+02	1.97E+00	6.83E-03	2.87E-02	4.98E-01	1.19E+00	1.00E+00	1.00E-03	-3.48E+00	3.35E-04	3.35E-07	3.21E-01	3.53E-01	(a)
Trichloroethene	79-01-6	1.31E+02	2.42E+00	1.16E-02	5.13E-02	5.81E-01	1.39E+00	1.00E+00	1.00E-03	-3.54E+00	2.87E-04	2.87E-07	3.35E-01	3.68E-01	(a)

TABLE 4-7
DERMAL WATER PARAMETERS
LOWER PASSAIC RIVER STUDY AREA A
BASELINE HUMAN HEALTH RISK ASSESSMENT

Chemical of Potential Concern	CAS Number	Constituent Properties		Dermal Water Parameters											Source
		MW g/mol	log Kow unitless	Kp (cm/hr)	B unitless	Lag Time τ hr/event	t* hr	FA unitless	Isc cm	log(Dsc/Isc) unitless	Dsc/Isc unitless	Dsc unitless	b unitless	c unitless	

Notes:

CAS - Chemical Abstracts Service.

PAH - Polycyclic Aromatic Hydrocarbons.

PCB - Polychlorinated Biphenyls.

PCDD - Polychlorinated dibenzodioxins.

PCDF - Polychlorinated dibenzofurans.

SVOC - Semi-Volatile Organic Compounds.

TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin.

TEQ - Toxicity Equivalence.

VOC - Volatile Organic Compounds.

(a) USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1, Part E, Supplemental Guidance for Dermal Risk Assessment. Exhibit B-3 (Organics)

Note that values were obtained from the spreadsheet provided with the guidance, therefore, rounding differs from that presented in Exhibit B-3.

(b) USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1, Part E, Supplemental Guidance for Dermal Risk Assessment. Exhibit 3-1. (Inorganics)

(c) Calculated. Log Kow and molecular weight obtained from the Risk Assessment Information System (RAIS). See equations below.

(d) FA assumed to be one.

(e) Values for PCB-hexachlorobiphenyl.

Equations:

USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1, Part E, Supplemental Guidance for Dermal Risk Assessment

Equation 3.8: $\log Kp = -2.80 + 0.66 \log Kow - 0.0056 MW$

Equation A.1: $B = Kp \times MW^{0.5} / 2.6$

Equation A.2: $\log Dsc/Isc = -2.8 - 0.0056 MW$, where $Isc = 1E-3$ cm. Solving for Dsc: $Dsc = 10^{-2.8 - 0.0056 MW} \times Isc$.

Equation A.4: $\tau = Isc^2 / (6 \times Dsc)$

Equation A.5: If $B \leq 0.6$, Equation A.5: $t^* = 2.4 \times \tau$

Equation A.6: If $B > 0.6$: $t^* = (b - (b^2 - c^2)^{0.5}) \times I^2_{sc} / (Dsc)$

Equation A-7: $b = (2 \times (1+B)^2) / \tau - c$

Equation A-8: $c = (1 + 3B + 3B^2) / (3 \times (1+B))$

Definitions:

B - Relative Contribution of Permeability Coefficient.

Dsc - Effective diffusion coefficient through stratum corneum.

FA - Fraction Absorbed.

Kow - Octanol-Water Partition Coefficient.

Kp - Dermal Permeability Coefficient.

Isc - Apparent thickness of stratum corneum.

MW - Molecular Weight.

 τ - lag time (hr/event).

t* - Time to reach steady state.

b, c - Correlation coefficients which have been fitted to the Flynn's data to give Equation 3.8.

**ATTACHMENT TABLE 1
CALCULATION OF BODY WEIGHTS FOR CHILD AGE GROUPS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Young Child (Age 1 to <7 Years)	
Age (years)	Mean Body Weight (kg) (a)
1<2	11.4
2<3	13.8
3<4 (data 3<6)	18.6
4<5 (data 3<6)	18.6
5<6 (data 3<6)	18.6
6<7 (data 6<11)	31.8
Average	18.8
	Rounded to 19

Adolescent (Age 7 to < 19 Years)	
Age (Years)	Mean Body Weight (kg) (a)
7<8 (data 6<11)	31.8
8<9 (data 6<11)	31.8
9<10 (data 6<11)	31.8
10<11 (data 6<11)	31.8
11<12 (data 11<16)	56.8
12<13 (data 11<16)	56.8
13<14 (data 11<16)	56.8
14<15 (data 11<16)	56.8
15<16 (data 11<16)	56.8
16<17 (data 16<21)	71.6
17<18 (data 16<21)	71.6
18<19 (data 16<21)	71.6
Average	52.2
	Rounded to 52

**ATTACHMENT TABLE 1
CALCULATION OF BODY WEIGHTS FOR CHILD AGE GROUPS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Older Child (Age 7 to <14 Years)	
Age (years)	Mean Body Weight (kg) (a)
7<8 (data 6<11)	31.8
8<9 (data 6<11)	31.8
9<10 (data 6<11)	31.8
10<11 (data 6<11)	31.8
11<12 (data 11<16)	56.8
12<13 (data 11<16)	56.8
13<14 (data 11<16)	56.8
Average	42.5
	Rounded to 43

Teen (Age 14<19 Years)	
Age (Years)	Mean Body Weight (kg) (a)
14<15 (data 11<16)	56.8
15<16 (data 11<16)	56.8
16<17 (data 16<21)	71.6
17<18 (data 16<21)	71.6
18<19 (data 16<21)	71.6
Average	65.7
	Rounded to 66

Notes:

** The calculations presented here are consistent with those used to derive the default values presented in USEPA 2014. The values here were derived for the specific age groups for LPRSA receptors.

(a) USEPA 2011, Table 8-1.

References:

USEPA 2011 - USEPA Exposure Factors Handbook (EFH): 2011 Edition. September 2011.

USEPA 2014 - Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors.

OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

**ATTACHMENT TABLE 2
CALCULATION OF BODY SURFACE AREA FOR CHILD AGE GROUPS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Young Child (Age 1 to <7 Years)											
Age	Mean Surface Area by Body Part (m ²)									Mean Total Area (m ²)	
	head (a)	arms (a)	hands (a)	legs (a)	feet (a)	forearms		lower legs		face (b)	whole body (c)
1<2	0.087	0.069	0.03	0.122	0.033	0.028	(d)	0.051	(i)	0.029	0.53
2<3	0.051	0.088	0.028	0.154	0.038	0.035	(d)	0.065	(i)	0.017	0.62
3<4 (data 3<6)	0.061	0.106	0.037	0.195	0.049	0.042	(e)	0.078	(j)	0.020	0.76
4<5 (data 3<6)	0.061	0.106	0.037	0.195	0.049	0.042	(e)	0.078	(j)	0.020	0.76
5<6 (data 3<6)	0.061	0.106	0.037	0.195	0.049	0.042	(e)	0.078	(j)	0.020	0.76
6<7 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059	(f)	0.124	(k)	0.022	1.08
Average (cm²) (n)	645	1,043	367	1,953	485	415		791		215	7,517
	Receptor-Specific Totals										
	Swimmer (sediment only), Wader					face, hands, forearms, lower legs, feet =				2,272	
	Swimmer (Surface Water only)					whole body =				7,517	

Adolescent (Age 7 to <19 Years)											
Age	Mean Surface Area by Body Part (m ²)									Mean Total Area (m ²)	
	head (a)	arms (a)	hands (a)	legs (a)	feet (a)	forearms		lower legs		face (b)	whole body (c)
7<8 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059	(f)	0.124	(k)	0.022	1.09
8<9 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059	(f)	0.124	(k)	0.022	1.09
9<10 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059	(f)	0.124	(k)	0.022	1.09
10<11 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059	(f)	0.124	(k)	0.022	1.09
11<12 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086	(g)	0.193	(l)	0.024	1.61
12<13 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086	(g)	0.193	(l)	0.024	1.61
13<14 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086	(g)	0.193	(l)	0.024	1.61
14<15 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086	(g)	0.193	(l)	0.024	1.61
15<16 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086	(g)	0.193	(l)	0.024	1.61
16<17 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102	(h)	0.212	(m)	0.025	1.94
17<18 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102	(h)	0.212	(m)	0.025	1.94
18<19 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102	(h)	0.212	(m)	0.025	1.94
Average (cm²) (n)	712	2,122	678	4,407	961	811		1,749		237	15,192
	Receptor-Specific Totals										
	Angler, Swimmer (sediment only), Wader					face, hands, forearms, lower legs, feet =				4,436	
	Swimmer (Surface Water only)					whole body =				15,192	

**ATTACHMENT TABLE 2
CALCULATION OF BODY SURFACE AREA FOR CHILD AGE GROUPS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Older Child (Age 7 to <14 Years)										
Age	Mean Surface Area by Body Part (m²)									Mean Total Area (m²)
	head (a)	arms (a)	hands (a)	legs (a)	feet (a)	forearms	lower legs	face (b)	whole body (c)	
7<8 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059 (f)	0.124 (k)	0.022	1.09	
8<9 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059 (f)	0.124 (k)	0.022	1.09	
9<10 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059 (f)	0.124 (k)	0.022	1.09	
10<11 (data 6<11)	0.066	0.151	0.051	0.311	0.073	0.059 (f)	0.124 (k)	0.022	1.09	
11<12 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086 (g)	0.193 (h)	0.024	1.61	
12<13 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086 (g)	0.193 (h)	0.024	1.61	
13<14 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086 (g)	0.193 (h)	0.024	1.61	
Average (cm²) (n)	690	1,836	600	3,847	867	706	1,539	230	13,129	
Receptor-Specific Totals										
	Boater (Paddler) face, hands, forearms, lower legs, feet = 3,942									

**ATTACHMENT TABLE 2
CALCULATION OF BODY SURFACE AREA FOR CHILD AGE GROUPS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Teenager (Age 14 to <19 Years)										
Age	Mean Surface Area by Body Part (m²)									Mean Total Area (m²)
	head (a)	arms (a)	hands (a)	legs (a)	feet (a)	forearms	lower legs	face (b)		whole body (c)
14<15 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086 (g)	0.193 (l)	0.024		1.61
15<16 (data 11<16)	0.073	0.227	0.072	0.483	0.105	0.086 (g)	0.193 (l)	0.024		1.61
16<17 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102 (h)	0.212 (m)	0.025		1.94
17<18 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102 (h)	0.212 (m)	0.025		1.94
18<19 (data 16<21)	0.075	0.269	0.083	0.543	0.112	0.102 (h)	0.212 (m)	0.025		1.94
Average (cm²) (n)	742	2,522	786	5,190	1,092	958	2,043	247		18,080
Receptor-Specific Totals										
	Boater (Rower)					face, hands, forearms			1,992	

Notes:

** The calculations presented here are consistent with those used to derive the default values presented in USEPA 2014. The values here were derived for the specific age groups and assumed body parts exposed for LPRSA receptors.

(a) USEPA 2011. Table 7-2. Recommended Values for Surface Area of Body Parts; Mean Surface Area by Body Part.

(b) Surface area of the face is assumed to be one-third of the head (USEPA 2004, 2011).

(c) USEPA 2011. Table 7-10. Mean and Percentile Skin Surface Area.

(d) Surface area for the arm x ratio of the forearm to the arm for the 2-year old, average of male and female (0.4) (EFH Table 7-8).

(e) Surface area for the arm x ratio of the forearm to the arm for the 4-year old, average of male and female (0.4) (EFH Table 7-8).

(f) Surface area for the arm x average of the ratios of the forearm to the arm for 6, 8 and 10 year-olds (0.39) (EFH Table 7-8).

(g) Surface area for the arm x average of the ratios of the forearm to the arm for 12 and 14 year-olds (0.38) (EFH Table 7-8).

(h) Surface area for the arm x average of the ratios of the forearm to the arm for 16 and 18 year-olds (0.38) (EFH Table 7-8).

(i) Surface area for the leg x ratio of the lower leg to the leg for the 2-year old, average of male and female (0.42) (EFH Table 7-8).

(j) Surface area for the leg x ratio of the lower leg to the leg for the 4-year old, average of male and female (0.4) (EFH Table 7-8).

(k) Surface area for the leg x average of the ratios of the lower leg to the leg for the 6, 8 and 10 year-olds (0.4) (EFH Table 7-8).

(l) Surface area for the leg x average of the ratios of the lower leg to the leg for the 12 and 14 year-olds (0.4) (EFH Table 7-8).

(m) Surface area for the leg x average of the ratios of the lower leg to the leg for the 16 and 18 year-olds (0.39) (EFH Table 7-8).

(n) Average for each body part over age range of receptor, multiplied by 10,000 cm²/m².

References:

USEPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment
Final. USEPA/540/R/99/005

USEPA 2011 - USEPA Exposure Factors Handbook (EFH): 2011 Edition. September 2011.

USEPA 2014 - Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors.

OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.

**ATTACHMENT TABLE 3
CALCULATION OF BODY SURFACE AREA FOR ADULTS
LOWER PASSAIC RIVER STUDY AREA
RESPONSE TO COMMENTS, BASELINE HUMAN HEALTH RISK ASSESSMENT**

Body Part	Mean Surface Area EFH Tables 7-12 and 7-13		Average of Males and Females cm ²
	Male m ²	Female m ²	
Total Body Surface Area	2.06	1.85	19,550
Head	0.136	0.114	1,250
Face (a)	0.045	0.038	415
Trunk/Neck	0.827	0.654	7,405
Upper extremities	0.393	0.304	3,485
Arms	0.314	0.237	2,755
Upper arms	0.172	0.130 (b)	1,512
Forearms	0.148	0.11139 (b)	1,297
Hands	0.107	0.089	980
Lower extremities	0.802	0.707	7,545
Legs	0.682	0.598	6,400
Thighs	0.412	0.364	3,880
Lower legs	0.268	0.233	2,505
Feet	0.137	0.122	1,295
Receptor Specific Totals			
Angler, Swimmer (sediment only), Wader	face, hands, forearms, lower legs, feet =		6,492
Boater	face, hands, forearms =		2,692

Notes:

** The calculations presented here are consistent with those used to derive the default values presented in USEPA 2014.

The values here were derived for the assumed body parts exposed for LPRSA receptors.

EFH - 2011 Edition of the Exposure Factors Handbook.

(a) - In accordance with USEPA (2004, 2011), 1/3 of head surface area used for face.

(b) In accordance with USEPA 2014 OSWER Directive on Recommended Default Exposure Factors, the female forearms and upper arms surface areas were calculated as follows:

Female arms [0.237] x (Male forearm/Male arms) [0.47]

Female arms [0.237] x (Male upper arms/Male arms) [0.55]

References:

USEPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E,

Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005.

USEPA 2011: Exposure Factors Handbook: 2011 Edition. EPA/600/R-09/052F. September 2011.

USEPA 2014 - Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors.

OSWER Directive 9200.1-120. February 2014 with April 2015 corrections.